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IMPROVED INJECTION MOLDED CENTRIFUGAL AIR IMPELLER

BACKGROUND OF INVENTION

Injection molded centrifugal air impellers with forwardly curved blades have an air flow pattern which is three dimensional. In the plane of rotation, there is a circulation that flows outwardly through the blades for approximately three hundred degrees (300°) of rotation. After passing the eye of circulation the flow reverses direction and passes back through the blades. Air flows into the blower inlet substantially along the section where the main circulation is outward. Although some air may flow out of the inlet along the section where the main circulation is inward, there is a net through flow of air out the blower discharge. The center of the main circulation is located near the inner edge of the impeller blades at the point where the flow reverses from outward to inward. Since the main circulation is larger than the impeller it is possible to have air velocities higher than blade tip speed and develop pressure coefficients greater than one. The ability of this type of impeller to achieve high performance in a small space is dependent on the regenerative effects of the main circulation as some of the flow is pumped through the impeller twice.

With the foregoing flow pattern in mind, optimum blade configurations must be provided. Since the flow direction reverses the blades do not have leading and trailing edges in the normal sense. High efficiency can only be achieved with optimum blade configurations particularly at the blade edges.

Prior art impeller designs have required mold parting lines between cavity and core along the outer edges of the blades. Shut off angles for long mold life, have resulted in irregularities along the blade outer edges and other conditions causing low efficiency and noise generation. A reduced shut off angle can result in shortened mold life and flash along the blade edge.

A general object of the present invention is to provide an improved impeller design well suited to plastic injection molding resulting in an optimum blade configuration.

SUMMARY OF THE INVENTION

In fulfillment of the foregoing object and in accordance with the present invention, the improved impeller accommodates a shut off or parting line intermediate the inner and outer edges of the blades. With the reversing flow pattern in mind, both inner and outer edges of the blades are provided with smooth uniform contours.

More particularly, the impeller design accommodates forming of an inner edge portion of each blade in the core of the mold and forming of an outer edge portion of each blade in the cavity of the mold. This allows for a proper shut off angle, which reduces the likelihood of flash at the parting line and minimizes mold wear.

As will be seen, the impeller back plate is designed so that the blades extend radially beyond the outer edge of the back plate. The inlet ring on the other hand extends radially beyond the outer edges of the blades but its inner edge resides inwardly of the blade outer edges. This ring configuration provides the required structural integrity and yet allows for a mold shut off which extends mold life and at the same time results in an aerodynamic advantage. Leakage flow around the blade ends at the inlet is inhibited and this enhances impeller performance High velocity leakage flow around the blade ends is known to disturb the inlet flow pattern and thus reduce efficiency.

DRAWINGS

Fig. 1 is perspective view partially broken away of a prior art impeller,

Fig. 2 is another perspective view of the Fig. 1 impeller, the opposite half being broken away with respect to Fig.1,

Fig.3 is a perspective view, partially broken away, of the improved impeller of the present invention,

Fig.4 is a schematic view along the axis of the impeller of Fig. 3.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring initially to Figs.1 and 2, a prior art impeller indicated generally at 10 has a back plate 12, a plurality of circumaxially arranged air moving blades 14,14 integral with the back plate 12, and an end ring 16 integral with the blades at an end thereof opposite the back plate. The outer diameter of the back plate coincides with that of the blades and the inner diameter of the end

ring coincides with the outer diameter of the blades. Thus, it will be apparent that the cavity of the mold forms only the inlet ring and the core of the mold forms the back plate and blades. It will also be apparent that the shut off and parting line must reside along the outer edges of the blades the aforementioned attendant disadvantages being encountered.

The improved impeller shown in Fig. 3 at 20 has a plurality of blades 22,22, a back plate 24, and an end ring 26. Each blade 22 has inner and outer edges 28 and 30 and adjacent inner and outer elongated portions 32 and 34 which extend longitudinally and which are partially defined by a mold parting line 36. The mold parting line 36 is displaced angularly from the blade centerline for ease in separating the mold parts. As will be observed, the parting line intersects the outer diameter of the back plate 24 at one end and the inner diameter of the end ring 26 at the other end. It is important that the end ring have an inner diameter, 36 Fig.4, greater than that of the blade inner edges, 37 in Fig.4, and an outer diameter, 38 in Fig.4, greater than that of the blade outer edges, 39 in Fig. 4. The back plate 24 should have a diameter at least equal to that of the inner edges 28,28 of the blades and as shown and preferred has a diameter somewhat greater than that of the blade inner edges. Reverting to Fig. 3, it will be observed that the inner edges of the blades are notched to receive the outer edge portion of the back plate. This provides a generous passage for the free flow of molten plastic to the blades during the molding operation.

The impeller design as described results in a molding process wherein the inner portions of the blades, from the parting line radially inwardly, are formed in the core of the mold and the outer portions of the blades, from the parting line radially outwardly, are formed in the cavity of the mold. The back plate is also formed in the core and the end ring in the cavity.

The precise location of the parting line on the blades may vary but it is preferred that the inner diameter of the end ring be approximately 2 to 5 per cent less than that of the outer edges 30,30 of the blades. Similarly, it is preferred that the outer diameter of the inlet ring be 2 to 5 per cent greater than that of the outer edges 30,30 of the blades.

As mentioned above, the improved impeller design, and particularly the location of the parting line at an intermediate portion of the blades, results in optimum design of the leading and trailing edges of the blades and in enhanced impeller performance. While the foregoing discussion has been directed to forwardly curved blades, impellers with other blade configurations will also benefit substantially from the design features of the improved impeller.

CLAIMS

1. A plastic injection molded centrifugal impeller comprising a circumaxially spaced series of air moving blades each having inner and outer edges and longitudinally extending inner and outer portions on opposite sides of an intermediate longitudinal line, an end ring at the inlet end of the impeller formed integrally with and interconnecting the blades, said ring having an inner diameter greater than that of the blade inner edges and an outer diameter greater than that of the blade outer edges, and a back plate formed integrally with and interconnecting the blades at an end thereof opposite the inlet ring, the diameter of the back plate being at least equal to that of the inner edges of the blades, and the foregoing characteristics of the impeller accommodating the molding of the blade inner portions in the core of the plastic injection mold and the molding of the blade outer portions in the cavity of the mold.